

D. Hamilton, who discusses the application of evolutionary concepts such as kin recognition and nepotism to humans and the controversy such generalizations engender. He considers the possible role of nepotism in human history, and calls for preservation of and respect for human racial and cultural diversity.

The basic approach taken by this work is an evolutionary one. As such it is complementary to the excellent and somewhat broader volume on recognition by Colgan (1983), which takes a more mechanistic perspective. Though *Kin Recognition in Animals* is quite broad, certain taxa are not well covered, such as sessile, colonial invertebrates and fish.

This book, with its extensive reviews of kin recognition over a broad range of taxa, will be a valuable reference book for advanced students, teachers, and researchers in social behavior and is a must for anyone seriously interested in kin recognition.—*Penelope F. Kukuk, Department of Entomology, Cornell University, Ithaca, New York 14853.*

#### LITERATURE CITED

Colgan, P. 1983. *Comparative Social Recognition*. John Wiley & Sons, Ltd., New York, 281 pp.

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**Pheromones of Social Bees.**—John B. Free. 1987. Cornell University Press, Ithaca, New York. xiii + 218 pp. \$29.95 (cloth).

In this modest 218 page compilation of research of the past 100 years, John Free applies his 30+ years of experience with bumblebees and honeybees to the task of summarizing our knowledge of the releasing and priming pheromones of the true honeybees, bumblebees, stingless bees, and even sweat bees, emphasizing, of course, *Apis mellifera*. Allomones and kairomones are by definition not addressed, nor are the semiochemicals of the non-eusocial bees, the latter having been summarized by Duffield et al. (1984). Pheromones, those ubiquitous intraspecific chemical messages that characterize Life, are the subject of this book, including queen, brood and worker pheromones.

The book is rightly organized by the sundry functional responses to pheromones, rather than by molecular class or glandular source. The functions are diverse, ranging from regulation of worker ovarian development and nestmate recognition to drone attraction and worker alarm. Free's task is not enviable, for the burgeoning literature of the biology of *Apis mellifera* is only exceeded by that of a few animals, such as the Norway rat and ourselves. Furthermore, social bees have been actively studied by groups on every continent, published in sometimes obscure or unexpected journals in several languages, and too often require careful *a posteriori* interpretation of an author's claimed evidences. Although Free may be a bit overly enthusiastic as to the sheer multiplicity of pheromones among the social bees, he is generally careful to weight conclusions judiciously as to whether they reflect independently confirmed pheromonal investigations, as yet unduplicated experimental results, or reports that

withstand alternative interpretations. This care is important, as much published research with *Apis mellifera* in particular necessarily involves rather artificial manipulations which can be prone to the introduction of artifacts, especially in the worker's behavioral responses.

In as much as sociality has arisen repeatedly among the bees, I am disappointed that Free did not develop more comparative evolutionary interpretations for the existence, functions, and glandular sources of pheromones of social bees. For instance, why is the Nasonov gland, releaser of the *Apis* worker's orientation pheromone, located near the dorsal tip of the worker's abdomen? Is an earlier purpose implied by homology, or are there analogous precedents from other social insects? Free brings little light to bear upon such evolutionary questions, but he does manage a carefully organized, descriptive summary of proximal function, complete with some innovative suggestions for apicultural applications. In surveying the literature, he also presents some of the methodologies of the chemical ecologist, though not those of the natural products chemist. The latter is clearly outside of his expertise.

The text has its share of accompanying figures, graphs, tables and flow charts, but for me, these are upstaged by his magnificently crisp and contrasty black-and-white photographs of bees-in-action. They verge on the artistic. Cited published references are pre-1985. His index is adequate. Free's message is clear: we know much about the pheromones of social bees, but far more lurks in the vast unknown. This book, in combination with Winston's (1987) and Seeley's (1985) books of the last several years, provide the callow melittologist, or at least apiculturist, with a coherent starting point from which to launch into those promising semiochemical unknowns without unwittingly reinventing the proverbial wheel.—*James H. Cane, Department of Entomology, Auburn University, Auburn, Alabama 36849.*

#### LITERATURE CITED

- Duffield, R. M., J. W. Wheeler and G. C. Eickwort. 1984. Sociochemicals of bees. Pages 387–428 in: W. J. Bell and R. T. Carde (eds.), *Chemical Ecology of Insects*. Sinauer Assoc., Sunderland, Massachusetts, 524 pp.
- Seeley, T. D. 1985. *Honeybee Ecology: A Study in Adaptation in Social Life*. Princeton University Press, New Jersey, 201 pp.
- Winston, M. 1987. *The Biology of the Honeybee*. Harvard University Press, Cambridge, Massachusetts, 281 pp.

#### ERRATA

Vol. 96, no. 2, pp. 140–175: The correct running head should be “STENO-OGASTRINAE.”

Vol. 96, no. 2, p. 228: The correct caption for Figure 1 should be: “Wygodzinsky (center) in field, 1955, Brown Canyon, Baboquivari Mountains, Pima County, Arizona, with Floyd G. Werner (left) and George Daniel Butler, Jr.